



U.S. Department
of Transportation
Federal Aviation
Administration

PROPOSED TECHNICAL STANDARD ORDER

Attached is proposed Technical Standard Order (TSO), **C92c**, Airborne Ground Proximity Warning Equipment for your review and comment.

Comments submitted must be received on or before August **4, 1995**, and must identify the **TSO file** number shown in the Federal Register notice dated May **3, 1995**, Vol. **60**, No. **85**, Page **21846**. Send all comments on the proposed **TSO** to:

Federal Aviation Administration
Technical Programs and Continued Airworthiness
Branch, **AIR-120**
Aircraft Engineering Division
Aircraft Certification Service • File No. **TSO-C92c**
800 Independence Avenue, SW.
Washington, DC **20591**

Distribution: **ZVS-326; A-W((IR))-3; A-X((RS))-3; A-FES-11, 22, 77, 88 (LTD) AAFAC-01(MAX)**
A-X((CD))-4; AIN-11 (2 cys)

PROPOSED TECHNICAL STANDARD ORDERS (TSO)

Subject: **TSO-C92c**, AIRBORNE GROUND PROXIMITY WARNING EQUIPMENT

(a) **Applicability.**

(1) **Minimum Performance Standard** This technical standard order (TSO) prescribes the minimum performance standard that airborne ground proximity warning system (GPWS) equipment must meet in order to be identified with the marking "**TSO-C92c.**" Airborne GPWS equipment that is to be so identified and manufactured on or after the date of this TSO must meet the minimum performance standards set forth in Section 2.0 of **RTCA, Inc. (RTCA)** Document No. **DO-161A**, "**Minimum Performance Standards for Airborne Ground Proximity Warning Equipment**," dated May 27, 1976..

(2) **Additions.**

(i) **Fire Protection.** All materials used shall be self-extinguishing except for small parts (such as knobs, fasteners, seals, grommets and small electrical parts) that would not contribute significantly to the propagation of a fire.

NOTE: One means of showing compliance is contained in Federal Aviation Regulations (FAR), Part 25, **Appendix E.**

(ii) **Aural and Visual Warnings.** The required aural and visual warning must initiate simultaneously. Each aural warning shall identify the reason for the warning such as "**terrain**," "**too low**," "**glide slope**," or other acceptable annunciation.

(iii) **Deactivation Control.** If the equipment incorporates a deactivation control other than a circuit breaker, the control must be a switch with a protective cover. The cover must be safety wired so that the wire must be broken in order to gain access to the switch.

(iv) **Mode 4 Flap Warning Inhibition.** A separate guarded control may be provided to inhibit Mode 4 warnings based on flaps being in other than the landing configuration.

(v) **Speed** shall be included in the logic that determines GPWS warning time for Modes 2 and 4 to allow additional time for the aircrew to react and take corrective action.

(vi) Advisories (callouts) of altitude above the terrain shall be provided during nonprecision approaches. These advisories are normally, but are not limited to **500** feet above the terrain or the height above airport (BAA) used in terminal (approach) procedures.

(3). Exception. An alternate means, resulting in equal or better accuracy, may be used in lieu of barometric altitude rate and/or radio altimeter altitude to meet the warning requirements described in **RTCA Document No. DO-161A**.

(4) Environmental Standard. The equipment shall be subject to the test conditions as specified in **RTCA Document No. DO-160C**, "Environmental Conditions and Test Procedures for Airborne Equipment/@ dated December **4, 1989**..

(5) Computer Software. If the equipment design includes a digital computer, the software must be developed in accordance with **RTCA Document No. DO-178B, "Software Considerations in Airborne Systems and Equipment Certification,"** dated December **1, 1992**.. In accordance with **RTCA/DO-178B**, Paragraph **9.3**., the applicant must submit the the following documents to the Manager, Aircraft Certification Office (**ACO**), **Federal Aviation Administration (FAA)**, having purview of the manufacturer's facilities, for review and approval.

Plan for Software Aspects of Certification (**PSAC**)
Software Configuration Index
Software Accomplishment Summary

All data supporting the applicable objectives found in Annex A, Process Objectives and Outputs by Software Level, must be available for review. For software developed prior to the availability of **RTCA/DO-178B**, Section **12.1.4** provides a method for upgrading a baseline for software development so that changes can be made in accordance with the criteria contained in **RTCA/DO-178B**.

NOTE: The FAA recommends that the **PSAC** be submitted early in the software development process. Early submittal will allow the applicant to resolve issues with the Software Aspects of Certification Plan, such as partitioning and determination of software levels.

NOTE: The applicant should substantiate software levels in the safety assessment process outlined in **RTCA/DO-178B**. If the equipment incorporates more than one **software levels**, appropriate partitioning of **different** software levels is required. As an alternative to substantiating the **software level(s)** in a safety assessment, the applicant may develop all software that affects navigation and integrity functions to at least the Level C criteria.

(b) Marking.

(1) To comply with **14 CFR** Section **21.607(d)(2)**, the **TSOA** holder shall identify the software and hardware with the part number, or shall utilize a separate part number that identifies the **software and hardware**. The part number shall include the software version and level(s) in accordance with **RTCA/DO-178B**, and the modification status of the hardware (drawing revision or dash number).

NOTE: If multiple software levels are marked, the installation instructions must clearly identify the software level or each function.

(2) The technical standard order authorization (**TSOA**) holder shall **legibly** and permanently mark each separate, major component of equipment with the name of the manufacturer, the **TSO** number, and the part number, if the Administrator finds that such marking is necessary in the interest of safety.

(c) Added Features. If the manufacturer elects to add features to the **GPWS** equipment, those features shall meet the same qualification testing and software verification and validation requirements as provided under this **TSO**. Examples of features that have been added to **GPWS equipment** are: using bank angle, acceleration, aircraft performance, **and/or** accurate aircraft positioning coupled with terrain data in the logic that determines a **GPWS** warning.

(d) Data Requirements.

(1) The following data are required by **14 CFR** Section **21.605**. The manufacturer must furnish the Manager, Aircraft Certification Office (**ACO**), Federal Aviation Administration, having purview of the manufacturer's facilities, one copy each of the following technical data:

- (i) Operating instructions.
- (ii) Equipment limitations.
- (iii) Installation procedures and limitations.
- (iv) Schematic drawings as applicable to the installation procedures.
- (v) Wiring diagrams as applicable to the installation procedures.
- (vi) Specifications.
- (vii) List of the major components (by part number) that make up the equipment complying with the standards prescribed in this **TSO**.
- (viii) An environmental qualification form as described in **RTCA** Document **DO-160C**.
- (ix) Manufacturer's **TSO** qualification test report.
- (x) Nameplate drawings.
- (xi) The appropriate documentation as defined in **RTCA** Document **DO-178B**.

(2) Each manufacturer **must** have available for review by the Manager of the **ACO** having purview of the manufacturer's facilities, the following technical data.

- (i) A drawing list, enumerating all the drawings and processes that are necessary to define the article's design.
- (ii) The functional test specification to be used to test each production article to ensure compliance **with** this **TSO**.
- (iii) Equipment calibration procedures,
- (iv) Corrective maintenance procedures (within **12** months after **TSO** authorization).
- (v) Schematic drawings.
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